

Preliminary Analysis On Development Of Mathematics Learning Tools Based Competence Profession In Trigonometry Topic For Vocational High School Majoring Of Information and Communication Technologies

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Abstract—This research is a descriptive qualitative research. The purpose of this research is to analyze the learning tools of mathematics at SMK. Methods in this research are the interviews, observations, and giving a detailed questionnaire. The results of this research indicate that: (1) learning mathematics at SMK need learning of mathematics tools based on professional competence in understanding mathematical concepts, (2) introductory material given to the students have to use the examples of information and communication technologies, (3) In the mathematics learning tool that will be developed contains learning steps that will help students to understand the concept of mathematics.

Keywords—*The Preliminary Analysis, Trigonometry, Learning tools based Competence profession, Majoring of Information and communication Technologies, Mathematical Problem Solving Ability.*

I. INTRODUCTION

Vocational high school or SMK are formal education that has specialize training to direct students to be graduates who are ready to plunge in a professional manner and move in the world of work. The Vocational high school was an educational institution to prepare for a potential human resources which can be absorbed by the world of work [1]. In this matter, the theory and practice of applicative nature has been given since the first entry in the hope of having a Vocational high school graduates of competence in accordance with the needs of the world of work. Therefore the students of SMK taught and directed to plunge into the world of work based on the competence of the profession that he get into appropriate areas of expertise.

Competence refers to the knowledge, skills, and values that are reflected in the habit of thinking and acting. Competence is the existing characteristics of the interconnected on a person against the criteria relating to the effectiveness or high performance in a job or a specific situation [2]. Therefore the competency is a specific skill that is owned by the students of SMK as base in entering the

world of work. The said Profession in KBBI interpreted as areas of work which is based on educational expertise (skills, vocational, etc.). In his profession required the existence of special skills and ethics as well as service standards. This sense contain the implication that the profession can only be done by people in particular in being prepared for it. Therefore the profession is a work that in carrying out its duties require/demand expertise that require training of mastery of a particular majors.

The competence profession expertise that is owned by someone in the world of work where everyone is competent will surely have the nature of profession in the of the knowledge he had. Same is the case with the students of SMK are prepared to plunge in the world of work, in which students already have respective competencies appropriate majors. Therefore the competence profession of students SMK is a special ability which is owned by the students themselves who have been trained and educated during the learning of appropriate majors and are ready to plunge into the world of work.

Based on the decision of the Director General of elementary and secondary education number: 130/D/Kep/KR/201 date: 10 February 2017 About the structure of the curriculum of vocational high school (SMK/MAK), that the vocational high school consists of nine majors include: (1) engineering and technology, (2) energy and mining, (3) information and communication technology, (4) health and social work, (5) agribusiness and Agro technology, (6) maritime, (7) the leading business and management, (8) Tourism, and (9) of the arts and creative industries. The ninth of these majors, each divided into several program expertise and competency expertise. Given the circumstances and conditions, and the time frame required, researchers simply choose one of the areas of expertise to serve as a research subject in developing learning based competence profession i.e. Majoring of Information and communication technologies in the in class X SMK. In addition, the field of information and

communication technology skills have much role in the workforce as well as its application in mathematics.

Mathematics is one of the subjects that are taught at vocational high school (SMK) and is the determinant of graduation the students of SMK. Mathematics also has an important role in creating a generation that has competence, reliable and quality. This is because math is one of the science that is the basis for other sciences [3]. Learning mathematics at SMK is a vehicle that facilitates the mathematical learning ability students based on competence that he had. One of the mathematical ability of students based on mathematical learning objectives contained in the Permendikbud Number 58 year 2014 RI was the ability of mathematical problem solving. It is as expressed by [4] that "solving the problem has an important function in math teaching and learning activities". It will show the responsibility, cooperation, competition, and learning engagement. In addition through mathematical problem solving ability, students in vocational high schools can apply the concepts and use of skills in dealing with the various problems of the real situation in the corresponding field of the world of work Forte.

Solving problems in mathematics often refers to the ability to infer new information from a specific data [5]. A stimulating motivation towards problem-solving intellectual progress, creativity and mental behavior aimed at creating better structures of knowledge. As a result, the problem of developing the curiosity and spirit of research indicates the usefulness of the subject taught by solving concrete problems [6]. This means that students` problem solving ability was greatly influenced by his motivation in learning.

The ability of the students of SMK in solving math problems in particular trigonometric material is controlled by the students need to SMK as a prerequisite determining graduation. Based on the results of the interview against the Math teachers who have been following the activities of SMK deliberation mathematics teacher in West Sumatra town of Bukittinggi on 23 September 2017 which is implemented by the UNP that learning math is done during It still uses the curriculum of 2013, RPP made by using a scientific approach to match the demands of the curriculum of 2013, there are some teachers who use LKPD. But in fact the learning objectives not achieved as expected and the low level of problem-solving ability students. In addition the tendency of his participants prefer being in a computer lab than the class of mathematics. In addition teachers subjects mathematics using mathematics learning device i.e. the same for all fields of expertise in CMS, as well as the context of the problem that is used is also the same.

To overcome this, the repair is performed against the device used learning i.e. through develop competency-based learning devices in the form of RPP and LKPD, which lists examples of appropriate problems concepts of Majoring of Information and communication technologies. This learning tools based competence profession still use the appropriate approach with scientific approach, i.e. 2013 curriculum as well as a model that is appropriate for the material being used. But in an introduction to the problem of using the concept of problem majoring of information and communication technologies. Therefore a learning tools that

will be used is different for each of the majors as well as vocational field, meaning the device is learning tools based information and communication technologies, one to one area of expertise and field of vocational students at vocational high school.

The same study ever done by [7] learning based competence profession through the development of learning modules in vocational high school. Based her research the modules based competence profession that have been developed to increase the motivation of learning activities, interests, learning, learning outcomes, the development of problem-solving ability mathematically, the understanding of the concept, and it can help the teacher in the learning process in the vocational high school. In addition, the problem solving ability and competence of students is very mathematical ability improvement interplay students [8]. This is in accordance with the form of the product to be developed i.e. increase the ability of problem solving through the competence of the profession of students.

But whether the form of implementation plan of learning (RPP) and the activity sheets students (LKPD) based competence profession can also enhance the ability of solving mathematical problems the students of SMK on majoring information and communication technologies was still unquestionable. To implement trigonometric learning in SMK, it is necessary to first competency based learning devices prepared profession in an attempt to improve problem solving abilities of the students of SMK on majoring information and communication technologies.

Based on the background of the above problems, the formulation of a problem in this research are:

1. Whether learning mathematics at SMK on the majoring of information and communication technologies requires learning tools based competence profession?
2. How do characteristics of the learning tools based competence profession that will be developed?
3. How does learning measures contained in the learning tools based competence profession?

Based on the formulation of the problem in the above goals will be achieved in this study are:

1. Designing a device of learning math tools based competence profession
2. Through the math competency-based learning the profession of creating Learning math is related to the field of information and communication technology skills students class X SMK in majoring information and communication technologies
3. To address the low level of activity and the ability of mathematical problem solving students in class X SMK in majoring information and communication technologies.

II. METHODS

Source data obtained from interviews, observations, and observations. Method of data collection in the form of a combination of interviews and direct observation. This interview was done with teachers and students while questionnaire sheets are only given to students only. Data analysis in this study uses the interactive analysis model consisting of data collection, data presentation, data reduction, and the withdrawal of the conclusions of the data.

Some of the stages are done to identify or analyze things needed on preliminary research is includes: (1) needs analysis, (2) analysis of the curriculum, (3) analysis of concept and (4) analysis of the students. Outline of a preliminary research activities can be seen in Table 1 below:

III. RESULT AND DISCUSSION

On the activities of the needs analysis, researchers collect information-information about the learning of mathematics in vocational high school or SMK through the interview against the students and teachers of mathematics teaching in vocational high school, observing the activities learning mathematics at vocational high school as well as learning devices used in learning mathematics teacher at vocational high school. This preliminary analysis is activities conducted over three days namely: (1) the first day was held on September 23, 2017 by conducting observation against the learning device made by each of the mathematics teachers, as well as conducting interviews of some teachers who follow the deliberation mathematics teacher (MGMP) mathematics in Bukittinggi carried out by faculty of mathematics and natural sciences, UNP; (2) the second day was held on September 25, 2017 at SMK Negeri 1 Lubuk Basung. Researchers conducting observation against the learning of mathematics as well as conducting interviews of some students; and (3) the third day was held on September 26, 2017 at SMK Negeri 1 Sintuk Toboh Gadang. Same with the activities performed on the second day.

Based on the preliminary analysis that has been done, the students understand the context of less direct mathematics and mathematical subjects considered not very important compared with the material productive on the field of expertise that he is interested in. As a result of mathematical subjects, teachers felt that although a lot of work done but in vain just because students aren't too heeded and followed it well. This is certainly not to be left well enough alone, but teachers need to know what exactly the needs of vocational high school students in learning.

The results of the interviews are done to the teachers on September 26, 2017, pointed out that one of the most difficult material followed by students is the material of trigonometry. In the previous semester students have always had difficulty in resolving problems such as trigonometry, such as determining the value of sine, cosine and the hand with the opposite in each quadrant, sine and cosine rules apply, as well as in the painting on the Cartesian diagram of trigonometric graphs. This is caused due to lack of interest or desire students in understanding material trigonometry. At the time of the observation activities of learning mathematics at SMK Negeri 1 Lubuk Basung on September 25, 2017, visible only small portions of the peserta which respond to a given study. Teacher math subjects must affirm mathematical concepts over and over more than four times to be understood by the students. Nevertheless, there are still students who look confused with the material discussed. During the learning process, most students SMK hard apply a mathematical formula, plan completion, paint a picture as well as determine the things that are known and asked a question. During the learning activities the teacher does not use LKPD but existing material in printed books only.

The results of the interviews obtained against three students of class X skills program computer engineering and networks (TKJ) at SMK Negeri 1 Lubuk Basung namely: (1) the students followed a difficult mathematical learning, (2) among all the subjects, only mathematics the most hated. (3) Students prefer happy with areas of expertise and more than happy to resolve the issue directly in the field, (4) the students prefer math classes are empty compared to the productive class. Based on the results of the interview against the students of class X TKJ in SMK Negeri 1 Lubuk Basung that interest in learning mathematics learning against the very concern. This means that many students give negative comments towards the learning of math that leads to the favorites bar on mathematical subjects. It is also apparent from the results of the workmanship problems solving ability tests such as in Figure 1:

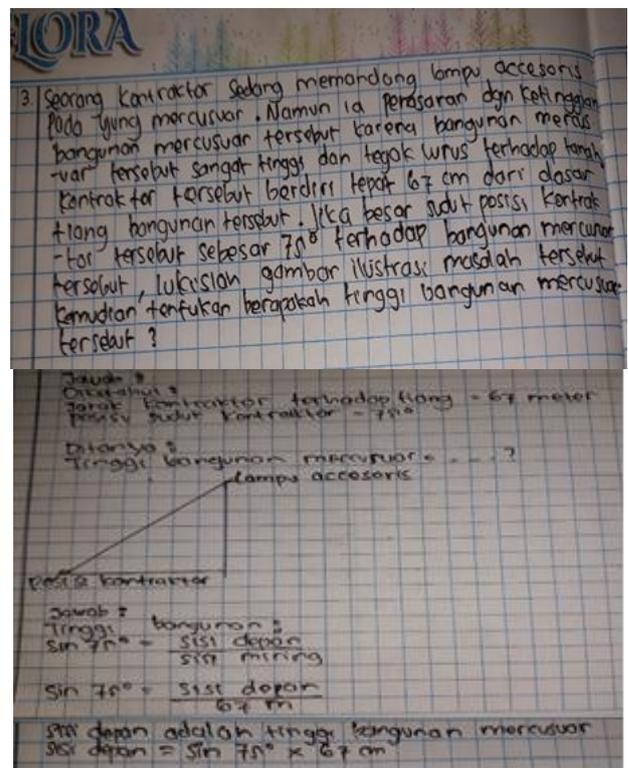


Figure 1. (a) a matter of troubleshooting capabilities of sine and cosine rules, and (b) answer the students

In Figure 1 seen students have not understood about the math concepts used to solve the problem. Expect results with results obtained from Figure 1 above, it is very much different than expected. This suggests that the ability of solving mathematical students is still lacking. In addition the same result was also obtained from the students of SMK Negeri 1 Sintuk Toboh, Gadang, through the implementation of the interview against the students on September 26, 2017. Of the three the interviewee, there was one person who said students like math. One of the students remarked that he would rather understand mathematics based on contextual that often exist in daily life as well as contextual attached of what he's interested in. Based on the results of the interview against the siswa, researchers are

increasingly motivated to find out more about the field of expertise is sought after the participant students, then associate it with math.

The students of SMK is very different with students of SMA, where the students of SMK better understand and interest as well as required to master the subjects appropriate productive areas of his expertise. This is due to the students of SMK are prepared to enter into the world of work, develop the appropriate profession competency areas of his expertise, and applies the competency of his profession into the world of work. Therefore the students of SMK considers that general subjects especially math isn't too important for he learned. Even so, the mathematical subjects in SMK apart has its benefits in the majors of the students, the subjects of mathematics as well as a determinant of graduation the students of SMK. This is a very serious concern by the teacher.

Based on the preliminary analysis that was done, the need for improvements of the device used during the learning of teachers. The improvement on the material, the concept of the given problem, as well as other techniques that are used on the steps of the learning activities. Therefore, researchers need to design the device context using the competence learning profession appropriate skills students at introduction of math. This designed learning device is able to help students understand mathematics through the context of the problem areas of expertise the students, making students are increasingly interested in learning mathematics through mathematical benefits against the field his expertise, as well as enhance the problem solving ability of students. Learning device that was developed in this study is learning tools competence profession activity sheets students (LKPD) implementation plan of learning (RPP).

2. Curriculum analysis

At this stage of the analysis of this curriculum, researchers conducting a review against the curriculum revision 2013 2016 for mathematical subjects in SMK. Analysis of the curriculum is conducted to see the suitability of core competencies (KI) and Basic Competence (KD), the Indicators of Competence Achievement (IPK) as well as the learning objectives in the matter of mathematics at SMK.

Based on Kepmendikbud number: 130/D/KEP/KR/2017 about vocational education curriculum structure that Basic Competence (KD) mathematics at SMK divided into two parts namely KD of Mathematics technology and KD of mathematics non technology. Given the circumstances and time researchers, analysis of the curriculum on the study done for the KD math technology in the majoring of information and communication technologies in class X semester even. Basic mathematics competencies of the X class specified by Kepmendikbud is arranged through by deliberation mathematics teacher of Math in SMK. The result of the deliberation mathematics teacher of Math in SMK is used as a reference in analyzing the curriculum on the study. Remember learning device that will be developed is a mathematical learning tools based competence profession, then researchers also need to analyze in math what are KD relating to the competence profession in the majoring of information and communication technologies

learner of SMK class X. Mathematical material taught in class X SMK techniques on the even semester based on Kepmendikbud 130/D/KEP/KR/2017 about vocational education curriculum structure is (1) growth, decay, interest and annuities, (2) Trigonometric, (3) The matrix, and (6) vector. But based on the results of the deliberation mathematics teacher of Math in SMK, not all the material taught in the mathematics class X SMK even semester because some have already entered into the previous semester and in part also in the enter class XI.

The results of the analysis of the curriculum implemented in SMK Negeri 1 Sintuk Toboh Gadang and at SMK Negeri 1 Lubuk Basung and interviews are made against teachers who follow the deliberation mathematics teacher of Math in Bukittinggi indicates that the material given in mathematics class X SMK techniques on the even semester is (1) growth, decay, interest and annuities, and (2) trigonometric.

However the material growth, decay, interest and annuities taught in semester even as an advanced material of the 1st semester, and sometimes not taught again in semester II. Due to the material growth, decay, interest and annuities fully taught in class X SMK semester techniques on the even numbered, and such content does not play a role in many of the competence profession in the majoring of information and communication technologies materials the device will be developed mathematics learning tools based competence profession in class X even semester is trigonometry.

Based on the results of the analysis of the curriculum is done, KD material trigonometry in classes X SMK in the majoring of information and communication technologies would be developed even in the first lesson that device can be seen in table 1 below:

Table 1. The results of the analysis of KI, Mathematics Curriculum Materials KD 2013 in class X SMK technology even semester.

Core Competencies	Basic Competence
Understanding, applying, analyzing, and evaluating knowledge about factual, conceptual, basic operations, and Metacognition in accordance with the field and scope of the study of mathematics at technical level, specific, detailed, and complex, with regard to science knowledge, technology, art, culture, and Humanities in the context of the development potential of the self as part of the family, the school, the world of work, the citizens of the community, national, regional and international	1.8. Determine the comparison of trigonometry in a right triangle
	1.9. Specify values for the angle of the closely related in various quadrants
	1.10. Determining cartesian coordinates to be polar coordinates and vice versa
	1.11. Apply the sine and cosine rules
	1.12. Applying trigonometric comparison on the graphs of trigonometric functions

3. Concept Analysis

At this stage of the analysis of this concept, the researchers determined the content of mathematical material to be learned in class X SMK in the majoring of information and communication technologies. In addition, of the contents of the specified material, researchers determined the concept, problems relating to the competence profession of students in the majoring of information and communication technologies.

The material studied in class X SMK on even-numbered Years semester Learning material is 2017/2018 trig. Based on the analysis of curriculum materials is done, trigonometry in classes X SMK technique consists of 5 basic competence. Based on the five basic competencies, competency achievement indicators 20 loaded (see Table 2). To achieve the required competency attainment indicators of material that are relevant and appropriate. Material that is required to achieve competence, achievement indicators can be seen in table 2 below:

Table 2. The achievement indicators.

Number	Learning Material
1	Measurement Angle
2	Comparison of Trigonometry
3	Comparison of Trigonometry in Different Quadrant
4	The angles are closely related
5	Polar coordinates and Cartesian coordinates
6	Sine and cosine rules
7	Graphs of trigonometric functions

4. Students Analysis

Activity analysis of students was implemented in two schools with different time on September 25, 2017 at SMK Negeri 1 Lubuk Basung and on September 26, 2017 at SMK Negeri 1 Sintuk Toboh Gadang. The subject in the analysis of these students are students class X with ages ranging between 15-17 years. Activities conducted on the analysis of these students are doing observations on learner characteristics grade SMK X through interviews and observations of the learning activities in the classroom. Learning activities against observations made at the time to follow the learning of mathematics and learning productive on the majoring of information and communication technologies.

Based on the results of the observations on the analysis of the students, obtained the following results:

1) The students hard to understand the context of mathematics. This is apparent when the teacher gives a math problem, students look confused, but already given the previous example in working on the problem;

2) The learner does not look serious and focused in the following learning math. This is because students consider not essential mathematics for students;

3) The students are more interested with the productive subjects in information technology areas of expertise compared to the mathematical subjects. If compared the results of observations of the students on the productive subjects with subjects of mathematics, students

leaning more interested and motivated in learning productive in the field of information and communication technology skills. However, in the learning of mathematics, students even looks less passion and consider not important mathematical subjects than productive;

4) The students prefer to learn by means of livelihood. Although students are not too interested in the learning of mathematics but when teachers deliver learning in a group, look the students discuss in complete context of the given problem teachers.

Based on the results of interviews conducted against students of class X CMS in the field of information and communication technology skills, obtained the following results:

1) The students considered subjects of mathematics is very difficult and hard to understand;

2) The students more interested in learning productive compared subjects mathematics;

3) Because it had a hard time with the subjects mathematics, eventually bored and are saturated in the classroom while mathematics learning takes place;

4) The students hard to understand the context problems are given.

Based on the results of the analysis of the students, researchers feel needs improvement against learning techniques through a learning device. Because the students more interested in learning about the field of expertise that is the profession to get into the world of work, then the researcher is designing a learning associate mathematics with skills students through mathematic learning tools based competence profession. Learning device that will be developed in the form of implementation plan of learning (RPP) and the activity sheets students (LKPD) containing about learning mathematics using the example or the context of the problem about the major of students.

Based on a preliminary analysis of data acquisition committed against learning, students and teachers, the curriculum used, learning tools used as well as efforts in the achievement of learning objectives in SMK on the majoring of information and communication technologies, obtained the following results:

1. Learning mathematics at SMK need the learning mathematics tools based competence profession in understanding math concepts,

2. Introductory material given to the students have to use the examples of information and communication technologies,

3. In the learning tools of mathematics to be developed contains steps of learning that will help students to understand concept of math.

IV. CONCLUSION

Learning using the mathematic learning tools based competence profession in class X SMK in the majoring of information and communication technologies that will be developed in the form of implementation plan of learning (RPP) and activity sheets students (LKPD). RPP and LKPD based competence profession will direct students to better apply her experience in the majoring of information and

communication technologies in finding mathematical concepts and solve math problems.

RPP based competence profession that will be developed will facilitate teachers in teaching math against the students of SMK on the field of information and communication technology skills. In a RPP based competence profession will be developed the mathematical material loaded by using the example in the majoring of information and communication technologies. So the teacher will uses a RPP based competence profession, it no longer hard to find examples or the relationship of the material to be studied against the field of expertise of the students.

Activity sheets students (LKPD) based competence professions contain activities that students refer to improved problem solving ability students. At LKPD based competence profession given the context of the problem about the majors of the students that can be solved using mathematical models. Through the context of the problems in the majoring of information and communication technologies, students will be more curious and increasingly keen to solve the problem given.

Mathematics learning tools based competence profession to be developed, not merely a mathematical problem solving ability students, but could increase the activity and motivation of the students in the learning of mathematics. Learning device that will be developed is expected to help teachers in the implementation of learning mathematics at vocational high school (SMK) through the competence profession of students.

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